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Vulnerability Discussions with Reference to MIDAS

About a year ago the Lockheed people completed a study on possible means of defeating MIDAS. Countermeasures to reduce the vulnerability of the system were also considered. The principal means of attacking the system were nuclear warheads and pellets. It seemed clear that no effective defense could be developed against an attack with nuclear weapons. However, a pellet attack seemed more reasonable on the basis of a cost analysis. Lockheed curves suggested that in the absence of any countermeasures, the economic advantage would lie with the Russians. They proposed adding up to 4 decoys per MIDAS satellite and on this basis assumed that they would make a pellet-type attack economically disadvantageous. Their discussion was based on the assumption that they could put up a MIDAS for about \$2 million each. This seemed unrealistic, and on further discussion there was at least some acknowledgment that the cost might be more likely \$10 million, which would invalidate their whole analysis. I believe it was fair to say that we finally concluded that with the present system if the Soviets knew where the satellites were, they could destroy them fairly easily, and that any countermeasures we might propose possibly would not change this conclusion. It is of course by no means clear that they would want to destroy the satellites, and I think the three of us felt that we should not necessarily assume that they would do so, nor should our failure to find a means of defense necessarily be taken as overwhelming evidence against developing the system.

The presently planned system operates with a number of commands being given from the ground. The possibility of the Soviets obtaining control by sending commands seems remote; however, it would seem to be fairly easy for them to jam the command links if they knew the satellite location. Interfering with the data link from the satellite to the read out station seemed a less likely possibility.

There was considerable discussion about the possible desirability of hiding the satellites as a means of protection, and by the end of the meeting both Harold and Jerry seemed to feel very strongly in favor of this. It was clear that the Lockheed people had paid little attention to this, and I believe it was Harold's and Jerry's position that they should do more. It should be possible by using coatings to make it very difficult for the Soviets to detect or track the

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satellite with radar; it would be more difficult to make the satellite so that it could not be observed optically using cameras. One of the advantages of a program where the satellites were hidden would be that a very high degree of coverage would not be necessary; that is, if one could really assume that the positions of the satellites were not known to the Soviets, one might accept quite large holes in the system. It would of course be necessary, if one were to try to hide the satellite, to avoid transmitting while over the Soviet Union. This implies delayed reports, and the possible disadvantages of this were not discussed in the session with Lockheed. However, the delays implied would be sufficiently substantial so that much of the early warning advantage of MIDAS would be lost.

There was considerable discussion of the desirability of flying on random orbits rather than using station-keeping satellites. There would be a very great advantage in doing this in that very unsophisticated decoys could be used, whereas if station keeping is employed, effective decoys would also need to have that capability. The presently planned system with 4 satellites in each of two planes would seem particularly vulnerable since a single SPAD type vehicle in each of the two planes might be used to destroy all the satellites in the same plane. Random orbits would of course preclude this possibility (as would also other station-keeping schemes). Finally, there might be a slight further advantage in having random orbits in that the reliability might be slightly improved, which would at least partly compensate for the cost of keeping more satellites in orbit. The Lockheed estimate was that they could do almost as well with 12 satellites in random orbits as with 8 programmed to keep station. Particularly because of the advantage of being able to use simple rather than sophisticated decoys, a random orbit scheme ought to be seriously reconsidered. It was our feeling that this was particularly true in view of the fact that the station-keeping decision seemed to have been based solely on an analysis involving flying at low altitudes where the payoff from station keeping in a saving on satellite numbers may be relatively more important than at the presently planned altitude.

In connection with the coverage question, we raised the possibility of increasing the number of read out stations, and I think concluded that this should probably be done. As I recollect, the cost of adding one station was estimated to be about \$10 million, which would seem small compared to the whole cost of the system.

The possibility of world-wide coverage was discussed, and it was estimated that in that case about 8 more stations would be required.

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The possibility of using Titan booster for MIDAS satellites was discussed, and it turns out that a Titan-B could probably put two satellites in 2000-mile orbits. This might be an attractive cost-saving measure, particularly if one were to settle on a random-orbit program.

The Lockheed people felt that probably their program should go ahead essentially as it was, but that backup in the way of more studies and some hardware development that would be useful in the event of a Soviet attempt to counter the system should be pursued. Apparently they have been quite constrained in what they have been doing along these lines by the Air Force, but I believe it was our feeling that probably it would be desirable if they would give a little more attention to the problems of vulnerability and countermeasures.

